Collaboration Engineering Approach to Enterprise Architecture Design Evaluation and Selection

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Abstract. Before an organisation takes up a particular enterprise architecture design, there is need to consider and evaluate the possible design alternatives, and then select an appropriate one. This process requires a collaborative effort involving all key stakeholders in order to obtain an *'acceptable'* solution. Therefore, in this paper we propose the development of a transferable, predictable and repeatable process that supports collaborative evaluation and selection of enterprise architecture design alternatives. To achieve this, we propose the use of collaboration engineering approach. Additionally, a fictitious case of airline mergers is used in order to demonstrate the; problem argued, rationale for solving it, effective and efficient way of solving it, and applicability of the proposed research. This research is under the supervision of Dr. Patrick van Bommel and Prof. Dr. H.A. (Erik) Proper.
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1 Introduction

IT infrastructure can adequately support a business, and a business can achieve optimum profits from IT development, if an enterprise has an explicit vision on the relation between its business and IT [9]. Alignment between business and IT requires an integration of all enterprise aspects, and enterprise architecture is a vital instrument for addressing company-wide integration [9]. Enterprise architecture guides managers in designing business processes, and application developers in building business applications in a way that matches with the business mission, vision, strategy and goals [10,15]. It is a framework within which decisions are made about essential units (that is, Business architecture, Information architecture, Information Systems (Data) architecture, Technology Infrastructure architecture, and Software architecture) of an organisation [17].

There are several definitions of enterprise architecture that exist in literature, however this research uses the definition presented in [10]. *"Enterprise Architecture a coherent whole of principles, methods and models that are used in the design and realisation of an enterprise's organisational structure, business processes, information systems and infrastructure"*[10]. Changes in the environment

(such as innovation, new competitors, globalization, new technologies, introduction of new business models and new regulations among others) always exist, yet organisations should be capable of adapting swiftly to such changes [15]. Enterprise architecture can help by providing management with insight and overview to embrace such complexity [15].

That can be possible if an organisation has an adequate, robust and *'acceptable'* enterprise architecture design. For large organisations, selecting such a design is a complex task that should involve all stakeholders from different units of the organisation. Moreover these stakeholders have multiple backgrounds, incompatible interests and deviating objectives [12], yet each stakeholder has a specific need for insight, control and overview [15]. Actually most of them are interested in the impact of the enterprise's architecture on their concerns [10]. Such *chaos* can be controlled by an architecture which is, according to [21], a *"prescriptive notion"* and *"a normative restriction of design freedom"*. Thus the increasing diversity and heterogeneity of concerns and stakes of stakeholders can be managed by a *'steering instrument'* of enterprise architecture [15].

A set of conflicting concerns and views will always arise during the process of an enterprise's architecture design. All concerns must be resolved and agreement reached through negotiation and understanding [19]. Moreover, the problem solving process should be social rather than individualistic, aiming at finding a working solution which can be embraced by all stakeholders rather than a *"right answer"* [5].

The remainder of this paper is structured as follows. In section 2 we discuss; the problem definition, research motivation, a fictitious case that demonstrates the problem argued, the research questions and objectives. In section 3 we present the relevant approach to the problem. The preliminary results are discussed in section 4, section 5 highlights the ongoing work, and finally the conclusion is given in section 6.

2 Problem Definition and Research Motivation

The process of selecting an adequate and *'acceptable'* enterprise architecture design for an organisation requires a collaborative effort of stakeholders, yet they have conflicting concerns and views that should all be addressed.

Therefore our motivation for this research is the need to help an organisation's stakeholders and enterprise architects to: (1) acquire a shared conceptualisation of the organisation's enterprise architecture design. We agree with [19] that a comprehensive understanding of processes, systems, and stakeholder concerns consequently facilitates the negotiation process; (2) agree on common evaluation criteria and an evaluation method for enterprise architecture design alternatives.

We must acknowledge existing related work. ArchiMate Foundation offers an improved support for the design, communication, realisation and management of architectures [19,3]; although an environment that enables stakeholders to collaboratively evaluate enterprise architecture design alternatives and select an

adequate one is lacking. Additionally, [17] presents economic methods and approaches for quantifying and managing the economic value of enterprise architectures, [18] presents a comparison of all existing enterprise architecture frameworks, and [14,13] present principles for adequately splitting an organisation. Conklin in [5] presents Dialog Mapping as a graphical technique for technically complex problems and socially complex groups (i.e. groups with widely differing views on a dynamically complex or wicked problem). Moreover [1,2] present an approach for collaborative architecting of enterprise applications (i.e. software architecture). However it should be clearly noted that software architecture is only part and parcel of enterprise architecture [17], and that this research is addressing the entire organisation's architecture.

Literature reveals alot of research (in several domains) addressing the issue of several stakeholders with conflicting preferences choosing among decision alternatives. But this issue has not yet been addressed in the field of enterprise architecture. Therefore an environment that enables stakeholders to collaboratively evaluate enterprise architecture design alternatives and select an adequate and acceptable design for an organisation is still lacking. This is what we are embarking on in this research.

2.1 Fictitious Case: Airline Mergers

We choose to demonstrate the problem argued and the rationale for solving it by using a fictitious case from the Airline Mergers' domain. Research work in [11,13,14,7] was our inspiration. In the fictitious case (figure 1), we make use of the system design guidelines presented in [21].

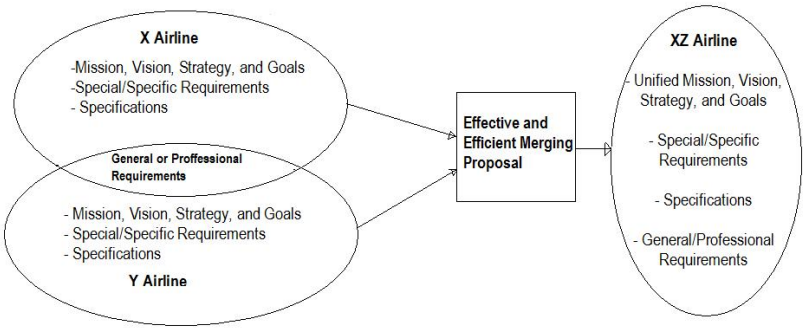

Fig. 1. The Fictitious Case: Airline Mergers

Consider two (or more) airlines X and Z, currently operating but with common desires of expansion, efficient operations, and increase in profits. The two airlines are considering an effective and efficient merging option. Some of the

merging implications include; a new XZ structure, business processes as well as an effective integration of applications, information, and information systems. However the mission, vision, strategy and goals of both X and Z airlines should be vital inputs to a unified mission, vision, strategy and goals of XZ airline. Moreover, there are several stakeholders involved in X and Z airlines, with different roles, stakes and concerns regarding the merging option.

Some of the key stakeholders involved and their concerns include: (1) Clients (*concerned about fares shooting, quality of services, and uncertainty of new operations*); (2) Staff (*concerned about job loss, uncertainty of new working conditions, and pay check weight*); (3) Shareholders (*concerned about; uncertainty of the quality of services, customer base, profits*); (4) Senior Management (*concerned about increase in customer base, reduction in operation costs, increase in profits, need for expansion, and gaining competitive advantage*); (5) Suppliers (*concerned about the uncertainty of the market for their services*); and (6) Government (*concerned about the possibility of high flight charges on passengers, and uncertainty of revenue collections*).

Generally, the overall concern is 'How can we achieve an effective, efficient, robust and *'acceptable'* merged XZ Airline?'. This can be addressed by having key stakeholders collaboratively evaluate enterprise architecture design alternatives for XZ airline and then select an *'acceptable'* design. This is because objects designed based on architecture have improved performance with respect to; integration, adaptability, agility, understanding, utilisation and engineering [21].

2.2 Research Questions

To address this concern, we search solutions to the following: (1) How can all key stakeholders of an organisation reach a shared conceptualisation and understanding of the enterprise architecture design concepts for the organisation? (2) How can we obtain common evaluation criteria and an evaluation method for design alternatives? (3) How can the key stakeholders collaboratively select an optimal enterprise architecture design for the organisation?

2.3 Research Objectives

The aim of this research is to develop a *transferable, predictable,* and *repeatable* collaboration process that will enable stakeholders to: (1) Achieve a shared conceptualisation and understanding of the enterprise architecture design concepts of an organisation; (2) Agree on common evaluation criteria and an evaluation method for the design alternatives; and (3) Collaboratively evaluate and select an optimal enterprise architecture design for the organisation.

Transferable describes a process that has a reduced conceptual load for practitioners so that they only have to learn the functionality and operation of a group support system [4]. *Predictable* describes a process that different practitioners use and get similar predictable results [4]. *Repeatable* describes a process that can be reused to minimise development time for new similar processes [4].

3 Group Model Building and Collaboration Engineering

Existing Group Support Systems provide value for several kinds of collaborative tasks, although they are facilitator driven [4]. Moreover maintaining skilled facilitators is not easy due to the economic and political issues involved [4]. Group Model Building is a vital approach in strategic decision making because it can: create new insights into strategic issues of a problem and enable stakeholders to acquire a shared reasoning about a problem; improve communication among the stakeholders; reduce conflicts; and reach a consensual agreement [20].

Collaboration Engineering is *"an approach for the design and deployment of collaborative technologies and collaborative processes to support mission-critical tasks"* performed by practitioners not skilled facilitators [4]. Therefore designing *"primary collaborative processes"* can achieve sustainable success with group support systems [4].

3.1 Design Approach

Collaboration engineering helps in designing transferable, predictable and repeatable processes [4]. The design approach for such processes is presented in [8] with the following iterative steps:

1. *Task Diagnosis:* involves determining the tangible or intangible goal, deliverables, and objectives of a collaboration process. The groups or individuals, their stakes, roles and concerns are also determined so as to foster acceptance of the process and results. For this research, our goal is to design a transferable, predictable and repeatable collaboration process for enterprise architecture design evaluation and selection.
2. *Task Decomposition:* involves determining the basic activities of the entire task, either by using an existing traditional approach or devising a new approach to address the task. For a new approach, activities should be logically sequenced and their deliverables determined. In our context of stakeholders collaboratively evaluating enterprise architecture design alternatives and selecting an adequate and *'acceptable'* design, no traditional approach exists, and this is what this research is addressing. Table 1 shows our results for task decomposition.
3. *ThinkLet Choice:* involves matching each activity with a thinkLet. For this research, this was done using the thinkLet selection criteria presented in [4,6]. Table 1 shows our results for thinkLet choice.
4. *Agenda Building and Design Validation:* entails a description of the requirements and specifications for each thinkLet, as well as information required to validate and evaluate the process designed. For this research, section 5 has more detail on validation.
5. *Documentation:* this occurs parallel to each of the above steps.

3.2 Patterns of Collaboration and ThinkLets

Successful collaboration requires concerned stakeholders to go through a reasoning process, which involves a series of activities regarded as "the basic patterns of collaboration" by [4]. These patterns of collaboration include; Diverge, Converge, Organise, Evaluate, Build Consensus [4]. Each pattern is created by very small units of intellectual capital known as ThinkLets [4]. ThinkLets are building blocks for designing collaborative processes [8]. ThinkLets are useful because: they define which group support system or tool (the version of hardware and software technology) to use; how to configure it; and they provide a clear sequence of events and instructions (oral or written prompts) for the group to follow when using the tool [4].

Therefore the thinkLet concept used in collaboration engineering and the group model building script concept seem very similar [16]. Since each pattern of collaboration has different thinkLets associated with it, in this research we selected the thinkLets shown in table 1 and figure 2 using the thinkLet selection criteria presented in [4,6].

4 Preliminary Results

The activities required to achieve the proposed collaboration process for enterprise architecture design evaluation and selection are shown in table 1. The deliverables expected from each activity and the corresponding pattern of collaboration as well as the appropriate thinkLet are also shown.

Table 1. Activities, Deliverables, Patterns of Collaboration and ThinkLets

No. Activity Name	Deliverable(s)	Pattern of Collaboration	ThinkLet
1. Stakeholders & Enterprise Architects meet and do the following; A. Share their concerns and views B. Agree on a common definition of concepts, C. Agree on common evaluation criteria & evaluation method for design alternatives	1A. Concerns and Views 1 B. Shared definition or conceptualisation of enterprise architecture design concepts. 1C. Common evaluation criteria and a common evaluation method for design alternatives.	1A. Diverge 1B. Converge 1C. Build Consensus	LeafHopper Pin the tail on the donkey MoodRing
2. Stakeholders and Enterprise architects generate design alternatives	A set of EA design alternatives	Diverge	LeafHopper
3. Enterprise Architects perform the following; A. Elaborate design alternatives B. Validate design alternatives C. Evaluate design alternatives	3A. Elaborated designs alternatives 3B. Validated design alternatives 3C. Evaluated design alternatives	3A. Organise 3B. Converge 3C. Evaluate	RichRelations Pin the tail on the donkey StrawPoll
4. Stakeholders meet and select an optimal EA design	Optimal EA design	Build Consensus	MoodRing

4.1 Synthesis

A Facilitation Process Model (illustrated in figure 2) has been designed to address the issue of collaborative evaluation and selection of enterprise architecture design alternatives. The model, hereafter refered to as the formulated solution synthesis is a hypothesis to address the research challenge. An explanation of the major activities or subprocesses involved is provided as well.

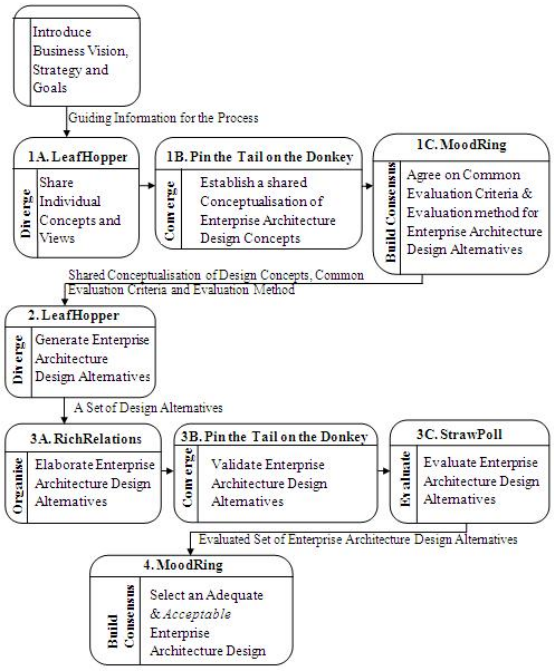

Fig. 2. The Facilitation Process Model for Collaborative Enterprise Architecture Design Evaluation and Selection

1. Introduce the vision, strategies and goals of the organisation (for example XZ airline). This is guiding information to stakeholders and enterprise architects. Requirements should be determined and specifications devised [21].
2. Key stakeholders should share their individual concerns and views, so as to achieve a shared conceptualisation and/or understanding of enterprise architecture design concepts for the organisation. Shared understanding involves; shared knowledge, shared meaning about the knowledge, mutual learning (where people learn from each other and advance their knowledge and group knowledge), and understanding of mutual differences or conflicts [8]. Additionally, stakeholders should reach consensus on common evaluation criteria for design alternatives and a common evaluation method.

3. Generation of enterprise architecture design alternatives for the organisation, this should be done by stakeholders and enterprise architects using, the common definition of concepts, requirements and specifications defined in step 2 above.
4. The generated set of enterprise architecture design alternatives must be further refined by enterprise architects to obtain a valid set of design alternatives. Enterprise architects should elaborate, validate and evaluate each design alternative using the common evaluation criteria and evaluation method generated in step 2.
5. Finally, stakeholders should collaboratively select an adequate and *'acceptable'* enterprise architecture design for the organisation (XZ airline).

4.2 Hypotheses

From figure 2 (i.e. the solution synthesis), the following hypotheses were deduced:

1. Collaboration engineering or a group model building script can solve the problem of conflicting concerns and views of stakeholders during enterprise architecture design, and enable stakeholders to achieve: a shared conceptualisation of an organisation design; common evaluation criteria; and a common evaluation method for enterprise architecture design alternatives.
2. Key stakeholders and enterprise architects can collaboratively generate enterprise architecture design alternatives for the organisation using an Expert System and a collaboration engineering approach.
3. Enterprise architects can effectively elaborate design alternatives for an organisation by using ArchiMate, effectively validate design alternatives using the common definitions and criteria determined by stakeholders, and can effectively evaluate the enterprise architecture design alternatives using a statistical approach.
4. Stakeholders can collaboratively select an adequate and *'acceptable'* enterprise architecture design for an organisation using a collaboration engineering approach.

5 Evaluation and Validation

We have used a fictitious case here to only demostrate the problem argued and applicability of our research. However, the fictitiuos case is not good for purposes of evaluation and validation of the formulated synthesis. Therefore a *real life case* will be used, and this is what we are currently working on.

In the evaluation and validation exercise, we make use of the four ways of design validation for collaboration processes presented in [8], these include: (1) *Walkthrough*, which is a step-by-step analysis of the entire task with practitioners; (2) *Simulation*, where the collaboration engineer answers the questions he posed in the design to investigate whether the answers can be used as input in the subsequent activities; (3) *Expert Evaluation*, where the design is discussed

with other experts in order to find alternative and/or better solutions to activities; and (4) *Pilot Testing*, which involves a small scale implementation of the process in order to assess its effectiveness and efficiency.

In this research, we intend to use all the four ways in order to achieve effective and efficient results regarding the *transferable, predictable* and *repeatable* properties of the process for collaborative evaluation and selection of design alternatives.

6 Conclusion

We have formulated and presented a solution synthesis as a hypothesis to address the research challenge of collaborative evaluation and selection of enterprise architecture design alternatives. Our ongoing work involves evaluating and validating the designed process (i.e. the solution synthesis) using a real case, in order to achieve a *transferable, predictable* and *repeatable* process. It should be noted that the fictitious case used herein only illustrates the applicability and significance of our research.

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